Savannah River Site

fact sheet

Environmental Exposure Pathways

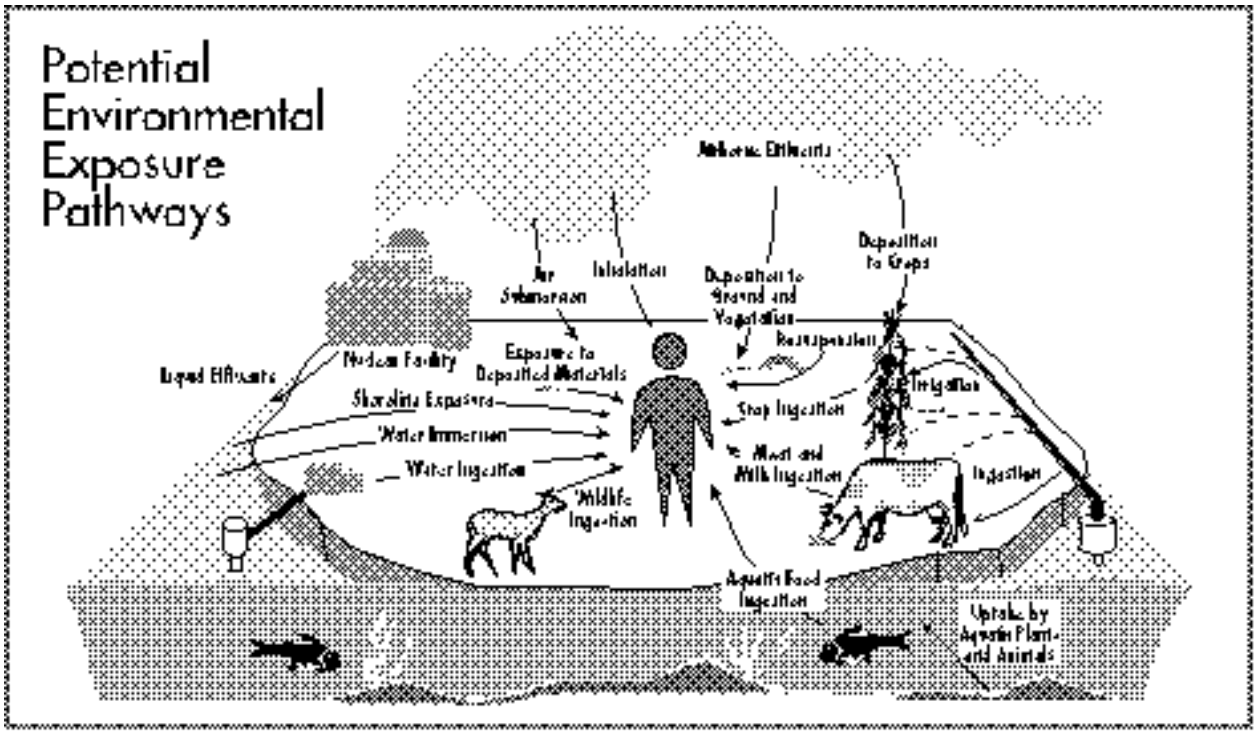

Figure 1

The Savannah River Site Environmental Dose Reconstruction Project's second phase focuses on the quantities of chemical and radioactive materials released from the site over the years and the ways the materials moved through the environment to people. Later work will complete the environmental pathways assessment, estimating the amounts and possible effects of materials that may have reached nearby residents.

Environmental Pathways

An environmental pathways assessment models the dispersion and transport of the materials released (called the source term) to estimate the concentration of chemicals or radionuclides in different parts of the environment over time. Airborne or aquatic releases follow different environmental pathways as they move through the air, surface water, groundwater, and soil as shown in Figure 1. A pathway's significance depends on the material released (chemical or radionuclide); type of release (airborne, liquid, or solid); physical and chemical form of the release; and environmental conditions (for example, meteorology, soil moisture, type of vegetation). Not all pathways are equally important contributors to human exposure. Based on knowledge gathered from past environmental research around the world and at the SRS, researchers will choose the most important pathways. Generalized models will be modified to represent the environment around the SRS as much as possible.

Food Chain

A number of interrelated pathways that link the source term to the food consumed by the people living around the site are grouped together and referred to as the food chain. The main source terms affecting the food chain are (1) the airborne effluents that are deposited on the ground or directly on crops and animal fodder and (2) liquid effluents that are in the water used for consumption or irrigation of crops. Figure 2 illustrates some of the important factors that influence these pathways.

The time and season in which the release occurs influence the type and quantity of food crops exposed. For example, the amount of leafy material available to catch and hold airborne releases varies during the growing season. The changes in diet of domestic and wild animals will influence how the food produced from these animals contributes to human exposure. The timing of releases relative to harvest can also be important, especially if the chemical or radionuclide has a short environmental or physical half-life. For example, the short-lived radioactive iodine-131 (8-day radioactive half-life) moves very quickly through the food chain to milk; however, within weeks after an isolated release, the amount of iodine-131 found in milk would be negligible.

The direct transfer of a chemical or radionuclide to plants through their roots is specific to each plant, but is also dependent on the physical and chemical characteristics of the soil. In some cases, a material collects in specific parts of animals or plants, so it is important to know which part will be used as food. The physical process of weathering can reduce the amount of material that stays on the surface of vegetation. Routine processing of food products can also reduce the amounts of chemicals or radionuclides consumed by people. In addition to determining the environmental transport of releases, it is important to consider how people interact with the environment containing the material released. If there is no contact, there will be no risk to human health. People interact with the environment by breathing the air, ingesting agricultural products or wild foods, and swimming, as examples.

Exposure Assessment

Exposure routes are evaluated as external or internal pathways. In Figure 1, possible external exposure pathways (resulting in exposures from outside the body) are air submersion, exposure to materials deposited on the ground, shoreline exposures, and water immersion while swimming. Internal exposures occur when a substance is taken into the body, via inhalation, drinking water, or ingesting foods (crops, meat, wildlife, and fish). We evaluate the total exposure through all significant routes during this research.

In future phases of the project, the SRS exposure assessment will consider actual demographic data to estimate exposures by age and sex. Food consumption rates and local food distribution patterns changed with time during the SRS operation and will be taken into account using this information. The origin of food consumed by the local population will also be investigated because certain foods were grown in areas unaffected by releases from the SRS. After the exposure assessment is complete, potential health risks will be estimated.

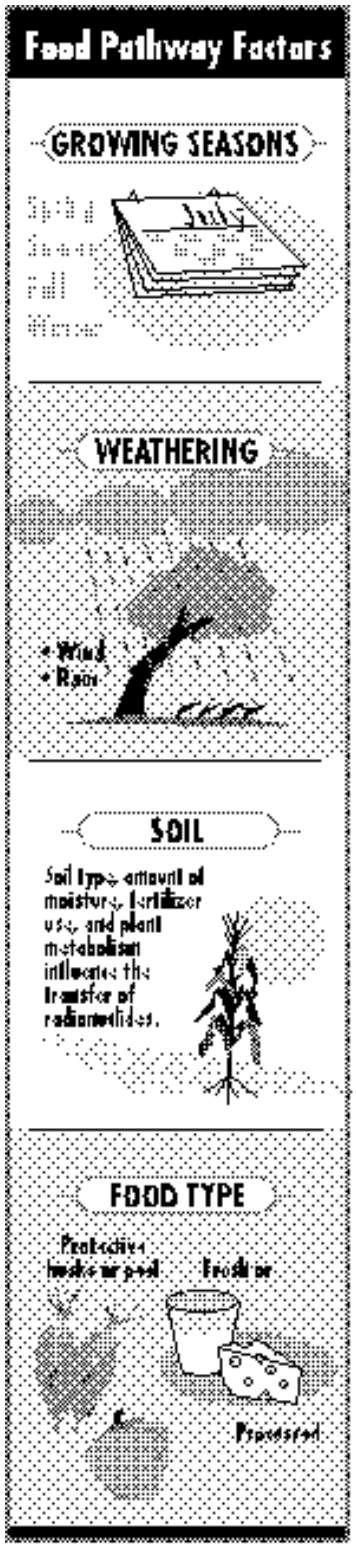

Figure 2

Public Participation

Public involvement is a key part of the dose reconstruction project. Throughout the course of the project, workshops and meetings are being held to explain progress and ask for ideas from people who are interested in the work. To obtain more information or to offer suggestions, please call our toll-free number, 800-637-4766.